



Strawberry DNA Extraction Lesson Plan

This lesson plan is for the extraction of DNA from strawberries. Strawberries are an exceptional fruit to use for this lesson because each individual student is able to complete the process by themselves and strawberries yield more DNA than any other fruit (i.e. banana, kiwi, etc.). Strawberries are octoploid, meaning that they have eight copies of each type of chromosome.

Primary Learning Outcomes

Students will observe first hand that DNA is in the food that they eat. Students will learn the simple method to extract DNA and why each step is necessary due to the complex organization of DNA in cells. Students will learn why it is important for scientist to extract DNA from organisms.

Assessed Georgia Performance Standards

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SB1. Students will analyze the nature of the relationships between structures and functions in living cells.

SB2. Students will analyze how biological traits are passed on to successive generations.

Background:

Strawberries are soft and easy to pulverize. Strawberries have large genomes; they are octoploid, which means they have eight of each type of chromosome in each cell. Thus, strawberries are an exceptional fruit to use in DNA extraction labs.

The soap helps to dissolve the phospholipid bilayers of the cell membrane and organelles. The salt is used to break up protein chains that bind around the nucleic acids. DNA is not soluble in ethanol. The colder the ethanol, the less soluble the DNA will be in it. Thus make sure to keep the ethanol in the freezer or on ice.

Procedures/Activities

Step: 1 Duration: 10 minutes

Teacher may choose prior to class to prepare the DNA extraction buffer. In a container add 900mL water, then 50mL dishwashing detergent (or 100mL shampoo), and finally 2 teaspoons salt. Slowly invert the bottle to mix the extraction buffer.



Step: 2 Duration: 40 minutes to 60 minutes depending on class cooperation

Lab procedures should be conducted as stated in the *DNA Extraction: Strawberry* lab at the end of this document. Modifications can be made based on the needs of the students. Some classes may decide for each student to add individual components of the extraction buffer to the Ziploc bag (roughly 2 tsp water, 1 tsp soap, 1 pinch salt), while other classes may choose to use the teacher prepared extraction buffer (from Step 1).

When the students add ethanol to their strawberry extract, they will see the fine white strands of DNA precipitate. The DNA will form cotton like fibers that will spool onto the stirring rod/inoculating loop/popsicle stick.

Materials and Equipment

For each student: heavy duty ziploc bag (freezer or storage bag); 1 strawberry; DNA extraction buffer (900mL water, 50mL dishwashing detergent, 2 teaspoons salt); small plastic cup to hold extraction buffer; cheesecloth to fit in small funnel (4" X 4" should be appropriate); small funnel; 50mL vial / test tube; glass rod, inoculating loop, or popsicle stick; cold ethanol, ice

Total Duration

10 minutes teacher prep before class

40-60 minutes in class

Assessment

Lab report and/or discussion questions. Discuss questions as a class to assess the students understanding and ability to communicate scientific concepts. Discuss why each step was needed and how this relates to the organization of genetic material.

Extension

The yield of DNA in this lab may be compared to that of the DNA Banana Extraction lab. Compare ploidy levels and how it may relate to the amount of DNA recovered. Use varying concentrations of ethanol (70-100%) to determine how ethanol concentration qualitatively affects the yield of DNA.

Name _____

Date _____

DNA Extraction: Strawberry

Background: The long, thick fibers of DNA store the information for the functioning of the chemistry of life. DNA is present in every cell of plants and animals. The DNA found in strawberry cells can be extracted using common, everyday materials. We will use an extraction buffer containing salt, to break up protein chains that bind around the nucleic acids, and dish soap to dissolve the lipid (fat) part of the strawberry cell wall and nuclear membrane. This extraction buffer will help provide us access to the DNA inside the cells.

Pre-lab questions:

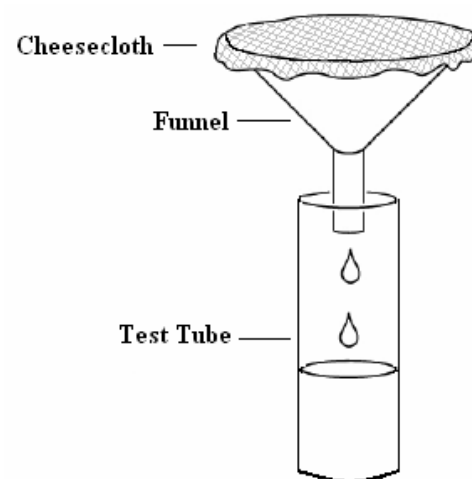
1. What do you think the DNA will look like?
2. Where is DNA found?

Materials:

heavy duty ziploc bag
1 strawberry
10 mL DNA extraction buffer (soapy, salty water)
cheesecloth
funnel
50mL vial / test tube
glass rod, inoculating loop, or popsicle stick
20 mL ethanol

Procedure:

1. Place one strawberry in a Ziploc bag.
2. Smash/grind up the strawberry using your fist and fingers for 2 minutes. *Careful not to break the bag!!*
3. Add the provided 10mL of extraction buffer (salt and soap solution) to the bag.
4. Knead/mush the strawberry in the bag again for 1 minute.
5. Assemble your filtration apparatus as shown to the right.
6. Pour the strawberry slurry into the filtration apparatus and let it drip directly into your test tube.
7. Slowly pour cold ethanol into the tube. OBSERVE ☺
8. Dip the loop or glass rod into the tube where the strawberry extract and ethanol layers come into contact with each other. OBSERVE ☺





Conclusions and Analysis

1. It is important that you understand the steps in the extraction procedure and why each step was necessary. Each step in the procedure aided in isolating the DNA from other cellular materials. Match the procedure with its function:

PROCEDURE

A. Filter strawberry slurry through cheesecloth

B. Mash strawberry with salty/soapy solution

C. Initial smashing and grinding of strawberry

D. Addition of ethanol to filtered extract

FUNCTION

___ To precipitate DNA from solution

___ Separate components of the cell

___ Break open the cells

___ Break up proteins and dissolve cell membranes

2. What did the DNA look like? Relate what you know about the chemical structure of DNA to what you observed today.

3. Explain what happened in the final step when you added ethanol to your strawberry extract. (*Hint: DNA is soluble in water, but not in ethanol*)

4. A person cannot see a single cotton thread 100 feet away, but if you wound thousands of threads together into a rope, it would be visible much further away. Is this statement analogous to our DNA extraction? Explain.

5. Why is it important for scientists to be able to remove DNA from an organism? List two reasons.

6. Is there DNA in your food? _____ How do you know?